NASA General Aviation Research

National General Aviation Roadmap

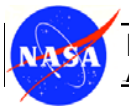
Small Aircraft Transportation System

Presented to
Northwest Aviation Conference
Puyallup, Washington
February 26, 2000

Bruce J. Holmes
NASA General Aviation Program Office

Figure 1

Outline



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The Golden Rule of the information age is "Time is the Scarce Commodity."

Early in the 21st century, the demand for personal transportation will soar beyond supply.

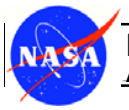
The Millennial Opportunity: SATS creates more time for more people.

SATS Concept

Community-Driven Opportunities

National Strategies

The Administration's 2001 Budget



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"Among other programs, Langley will see new funds directed to the "Small Aircraft Transportation" Program, which will fundamentally change our future air transportation system for both business and personal air travel. The small aircraft transportation program will enable travel for the public at their convenience--any time, any where to over 4,000 airports--not the 400 airports used today with our over crowded hub and spoke system--and we'll do it with the same level of safety of today's commercial jet transport aircraft."

Senator Charles Robb (VA)
at NASA Langley Research Center
January 7, 2000

Solving 21st Century Transportation Challenges

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SMALL AIRCRAFT TRANSPORTATION SYSTEM
SATS

The Small Aircraft Transportation System is a safe travel alternative, freeing people and products from transportation delays, by creating access to more communities in less time.

Demand Will Soon Exceed Supply

...not even considering pent-up travel demand...

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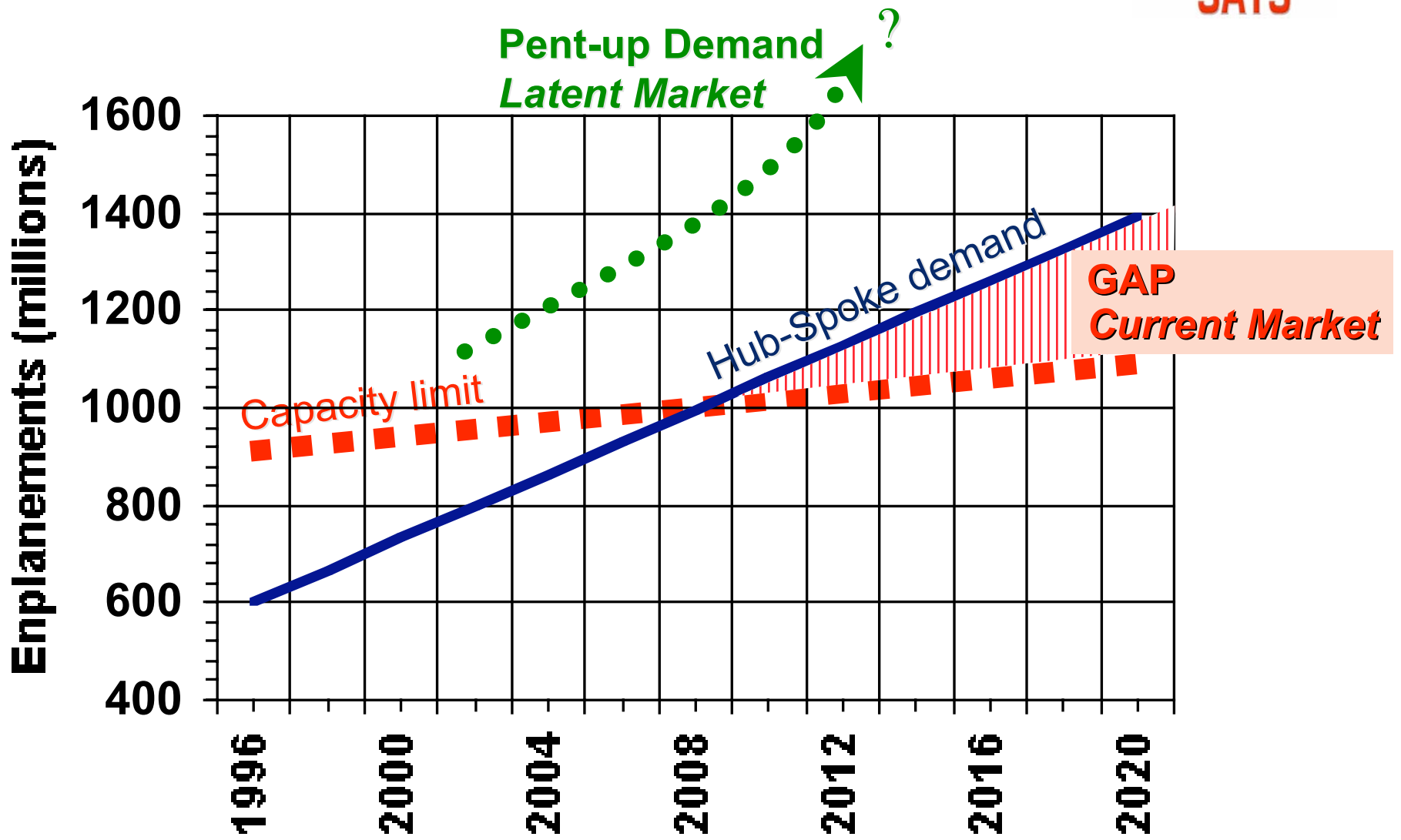

Figure 5

Pent-up Demand (http://apats.org)

"How many more trips would you take annually if you could save time?"

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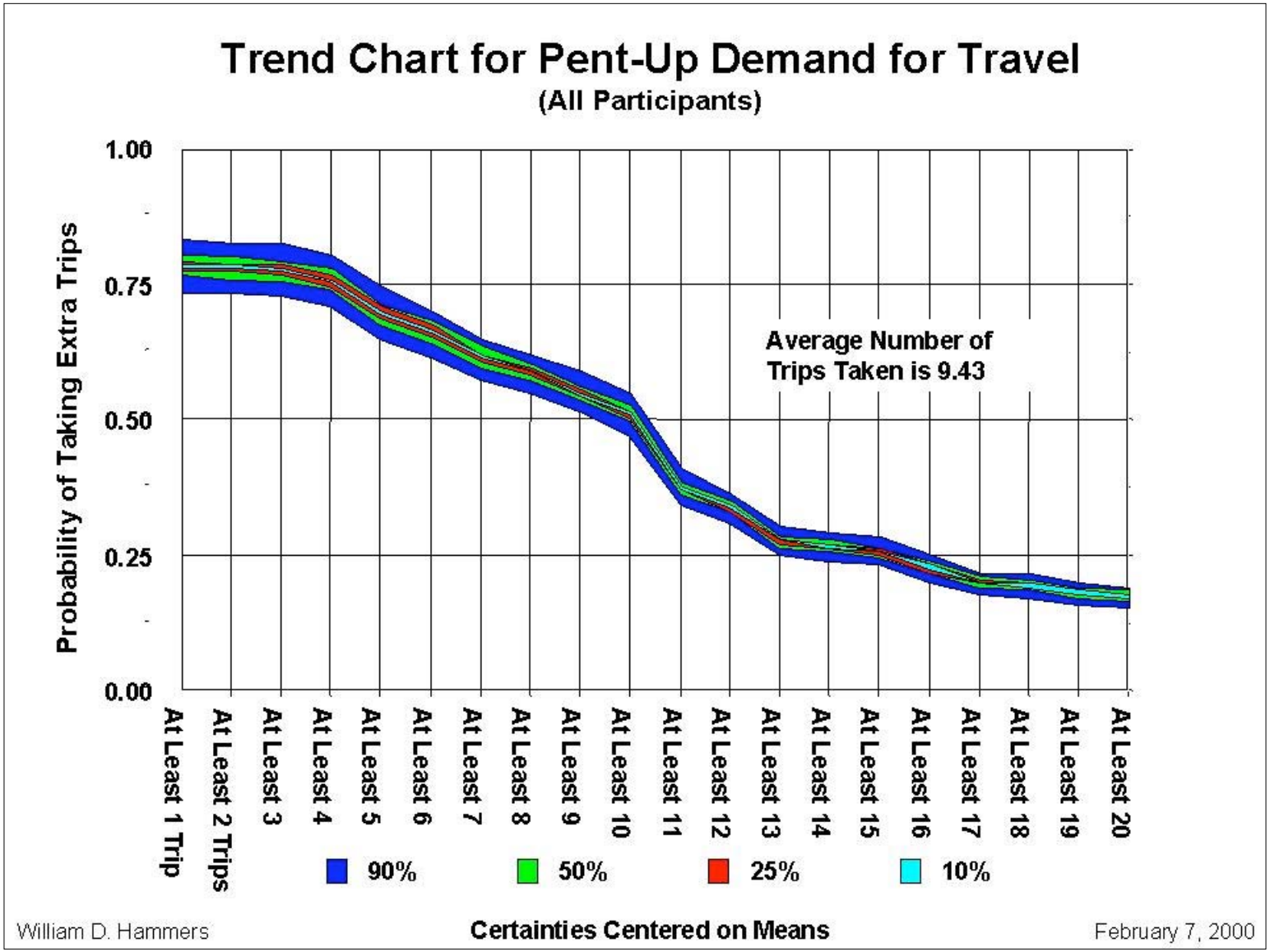

Figure 6

Innovation and Cost Life Cycles

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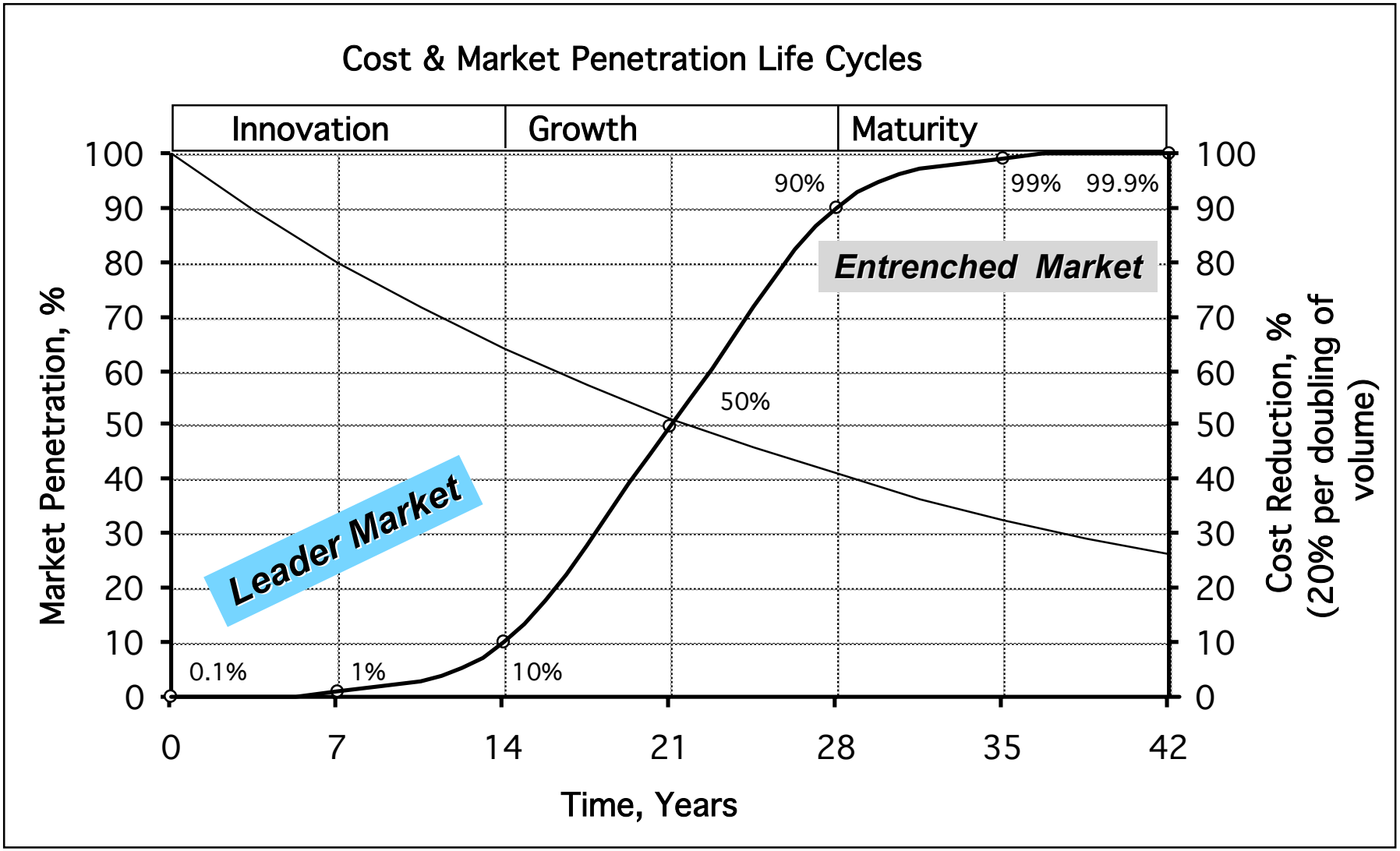

Figure 7

Life Cycle of the Piston Aircraft Market

…or is it really?…

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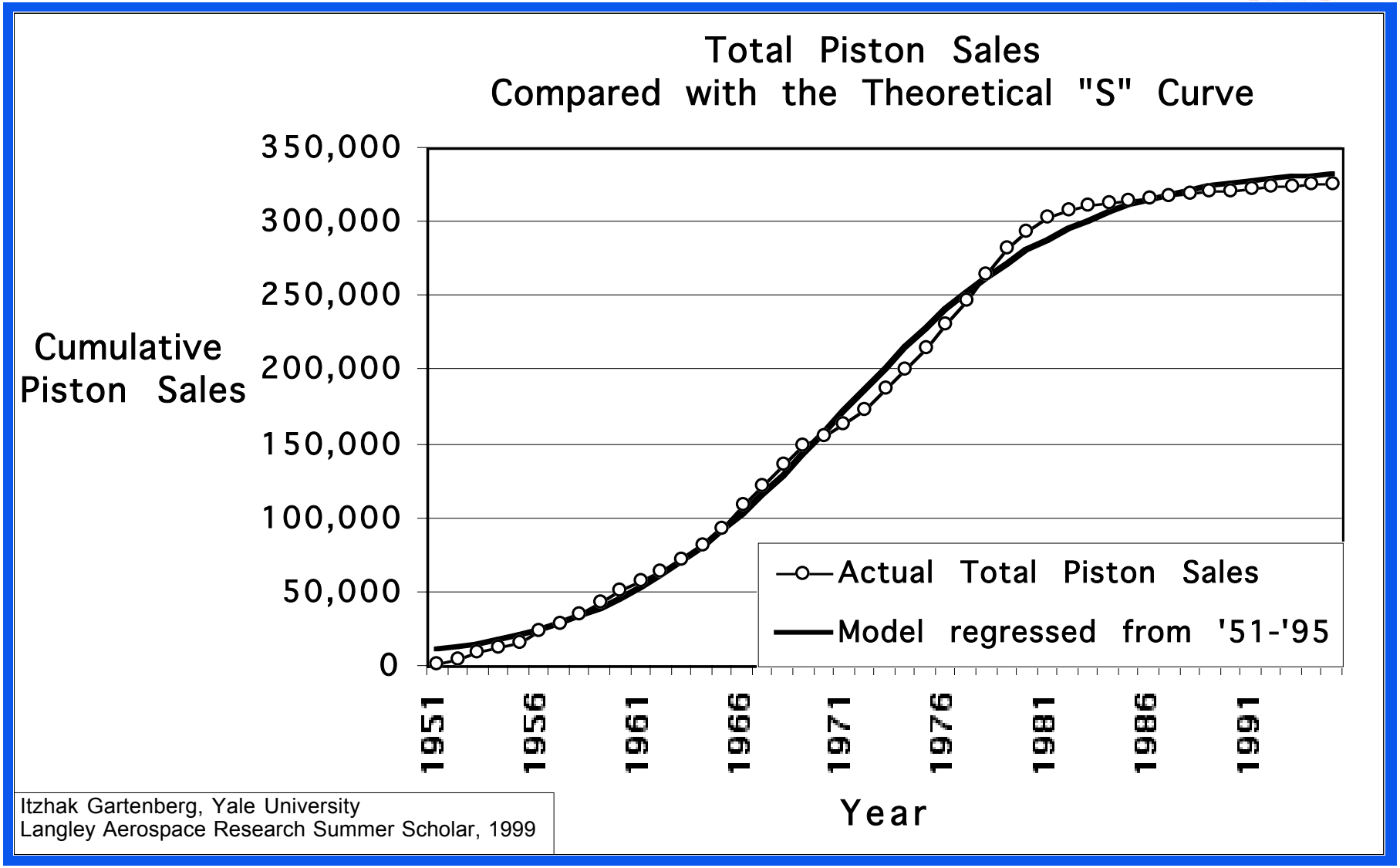
SMALL AIRCRAFT TRANSPORTATION SYSTEM
SATS



(R)evolutions in Higher Speed Travel

What is Next? More Speed to More Destinations

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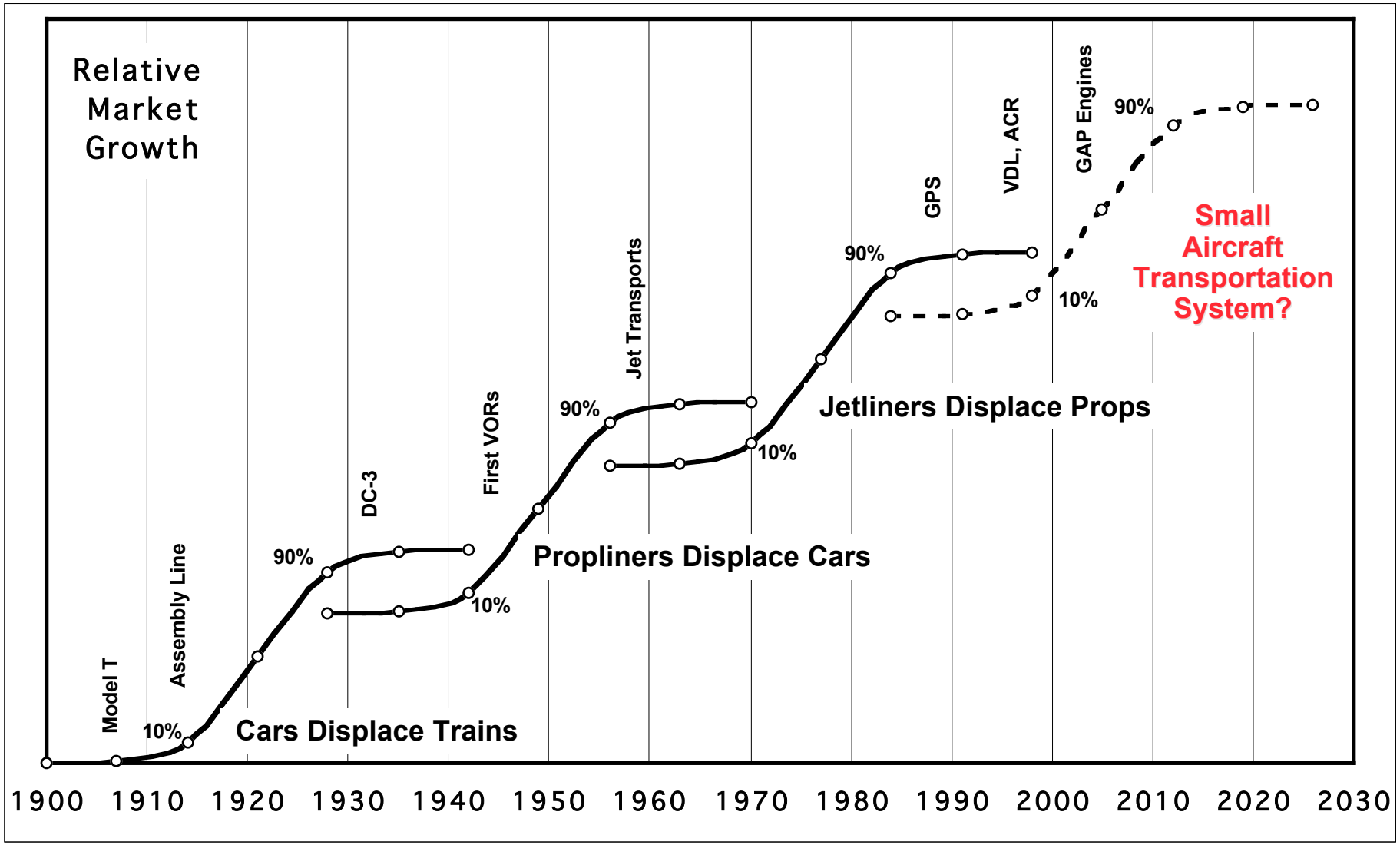
SATS

The "Atomic Structure" of Business Innovation Cycles



Small Aircraft Transportation System Mobility

"...doorstep-to-destination at four times the speed of highways..."

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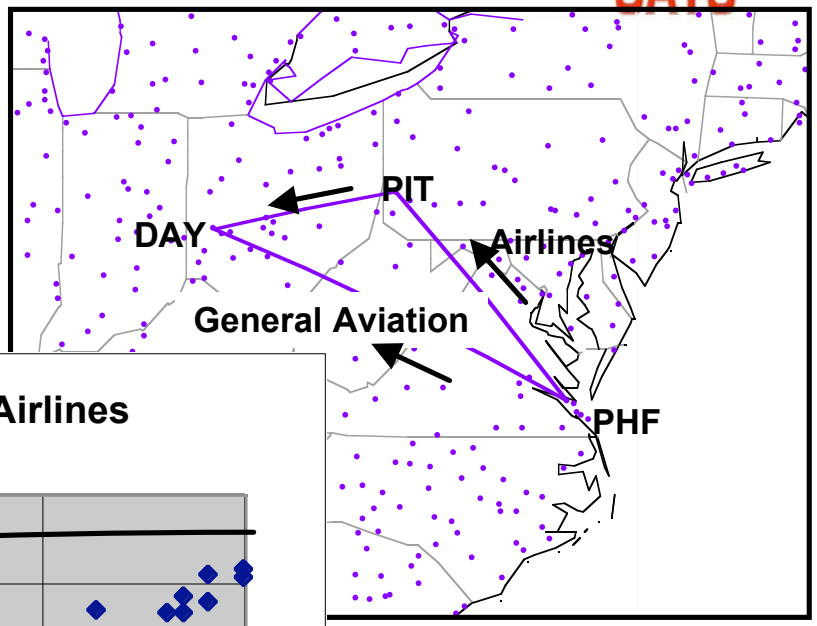
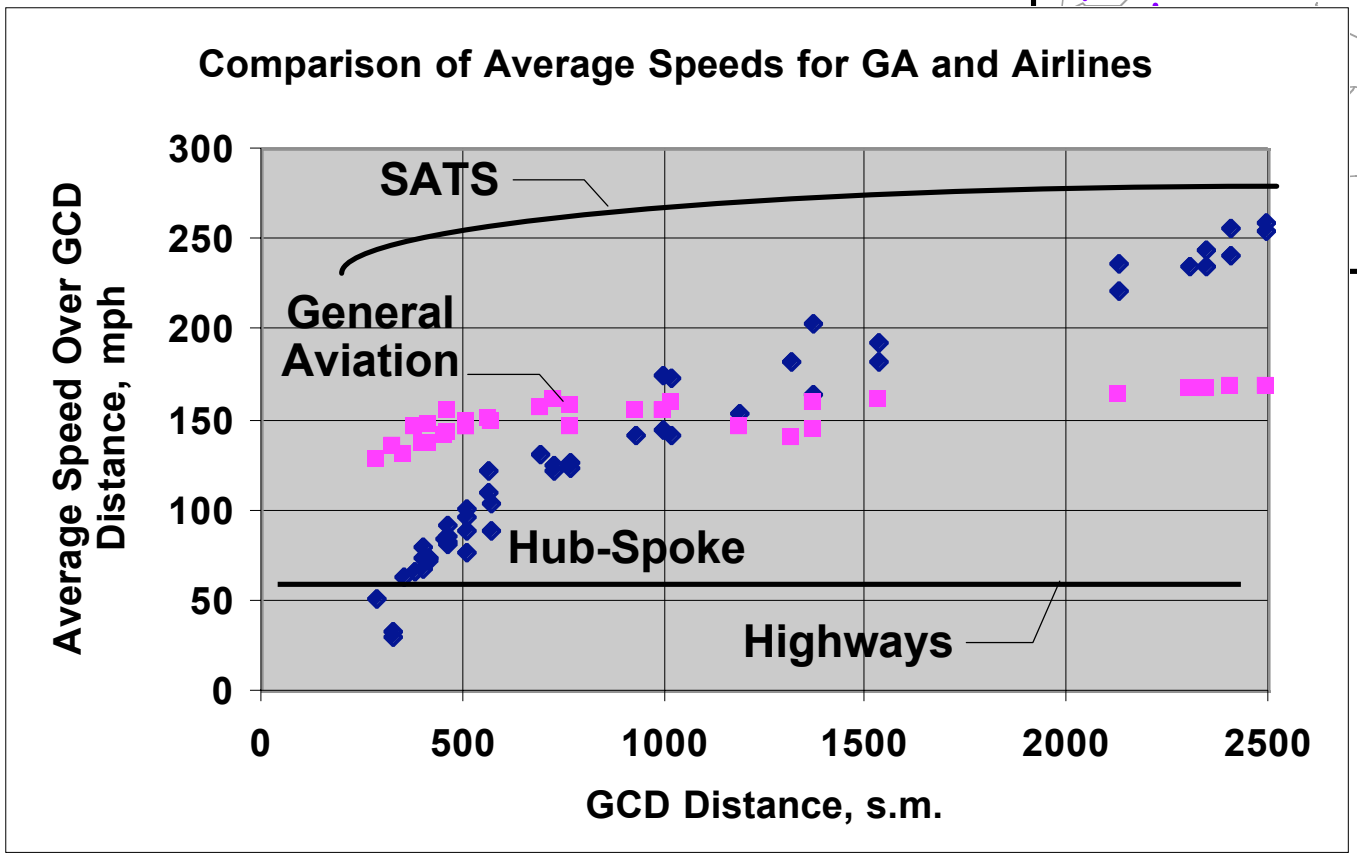
SATS

SATS reduces travel times, while highways and Hub-and-spoke travel times will continue to increase.





- Hub-Spoke: OAG times for 28 destinations
- General Aviation: time-optimized flight plans
- Including intermodal penalties (:45 +:45 for airline & :30+:30 for GA departure & arrivals)
- No GA destination benefit (for proximity of airports)
- SATS with new GAP engines: costs equal current General Aviation at 2 times the speed.

Figure 10

SATS Increases Accessibility and Mobility

(". . .creating access to more communities in less time. . .")

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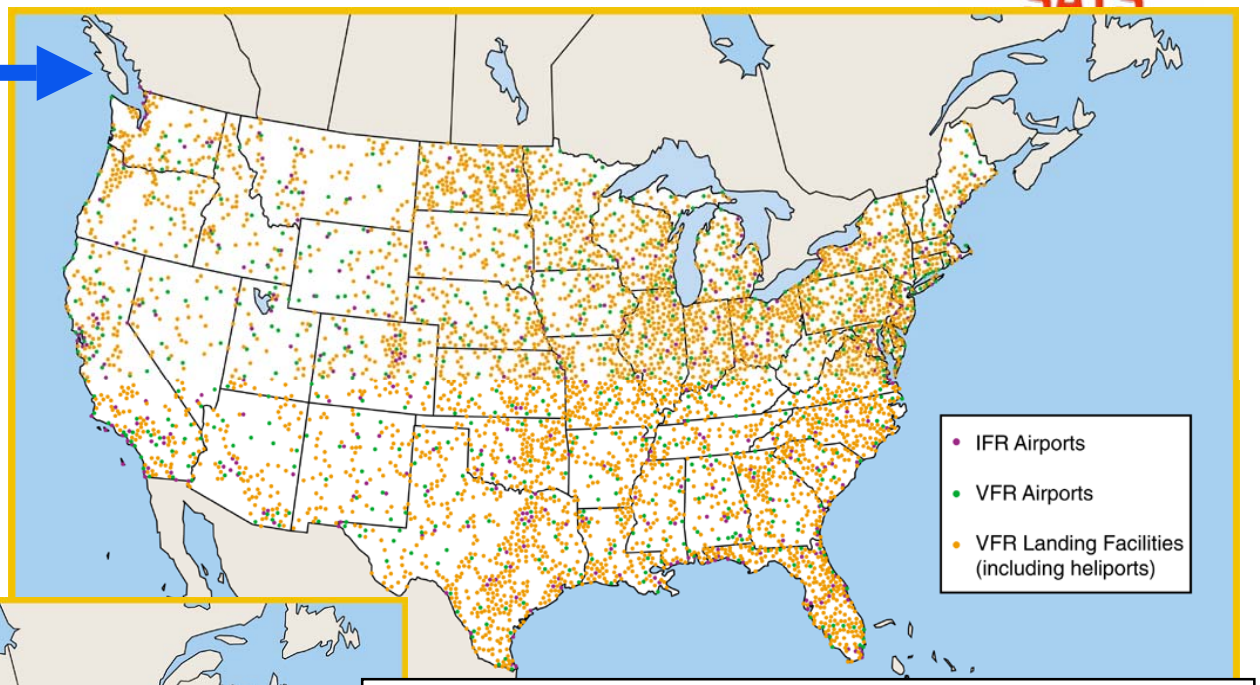
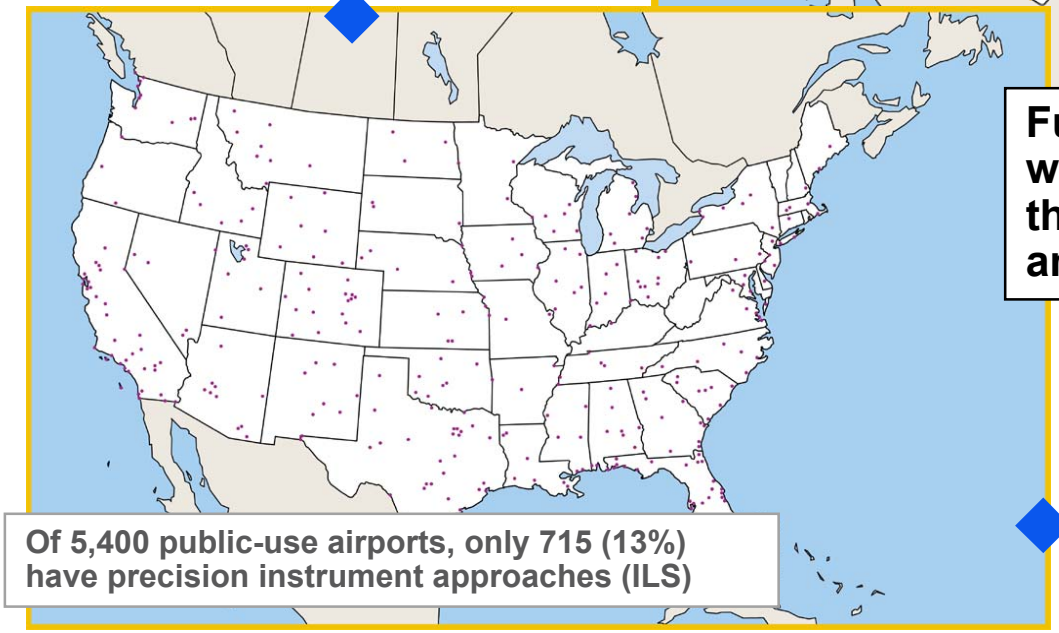
Expanded <u>Accessibility</u> to several times more destinations





Of 5,400 public-use airports, only 715 (13%) have precision instrument approaches (ILS)

Fully utilized 5,400 public-use near-all-weather landing facilities can increase theoretical NAS Throughput by more than an order of magnitude

Improved <u>Mobility</u> saving more travelers more time

The Next Generation Cockpits and Aircraft

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Lancair Columbia 300

Cirrus SR-20

21st Century
Propulsion

and Others….

Coming Soon
to an airport near you!

Precision Guidance to Every Runway End in America

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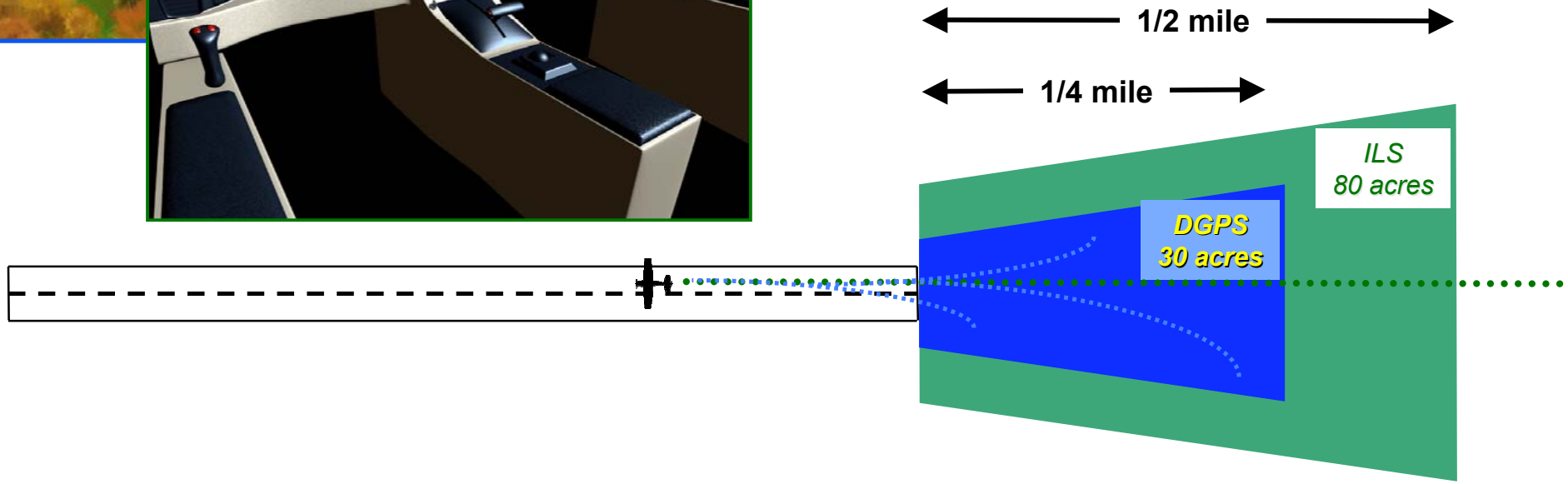
SMALL AIRCRAFT TRANSPORTATION SYSTEM
SATS

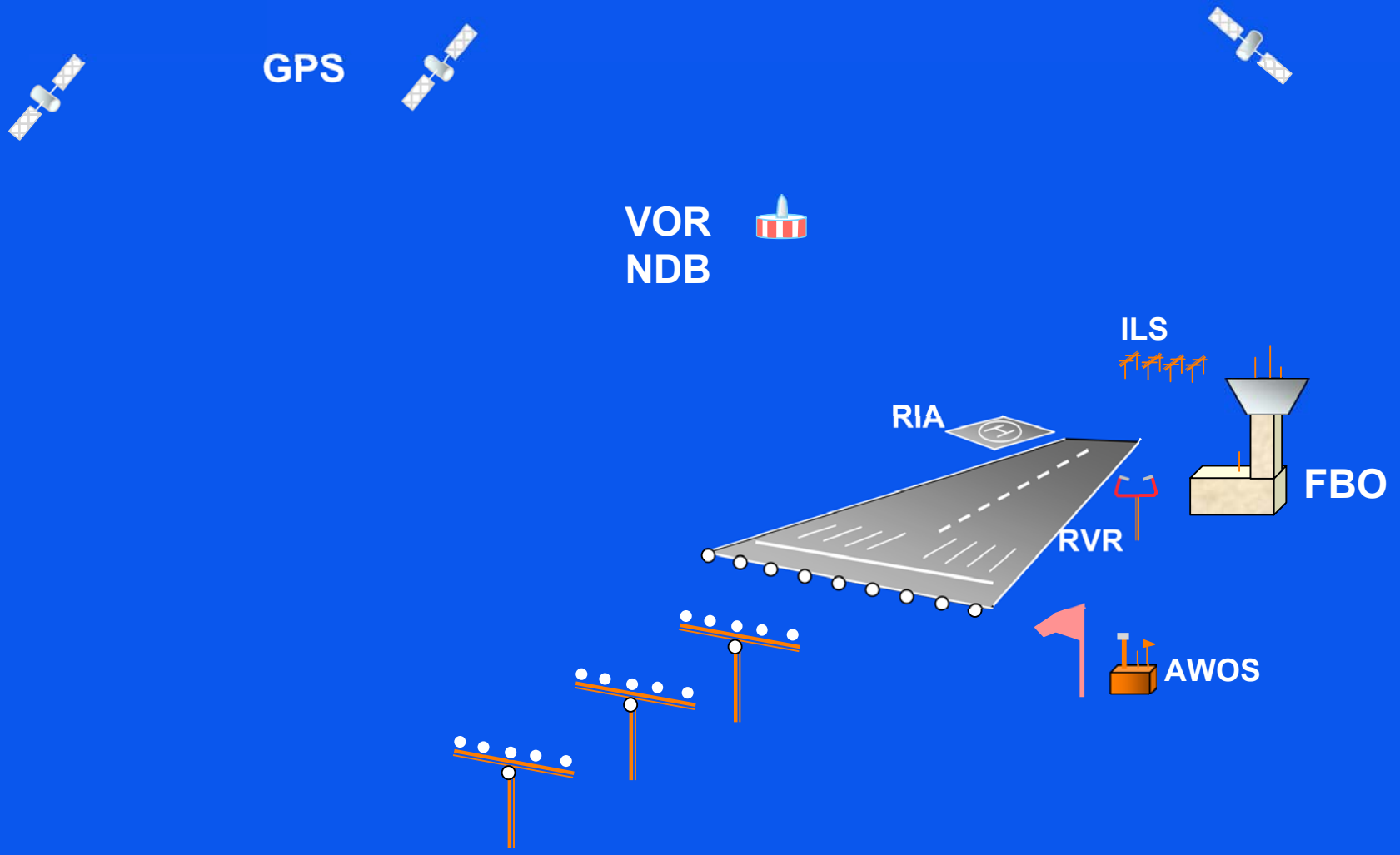
Highway in the Sky / Synthetic Vision with "Virtual" Approach Procedures:

- **Saves land**
- **Limits noise**
- **Increases safety**

Runway Protection Zone (RPZ)



GA Landing Facilities: Past and Future

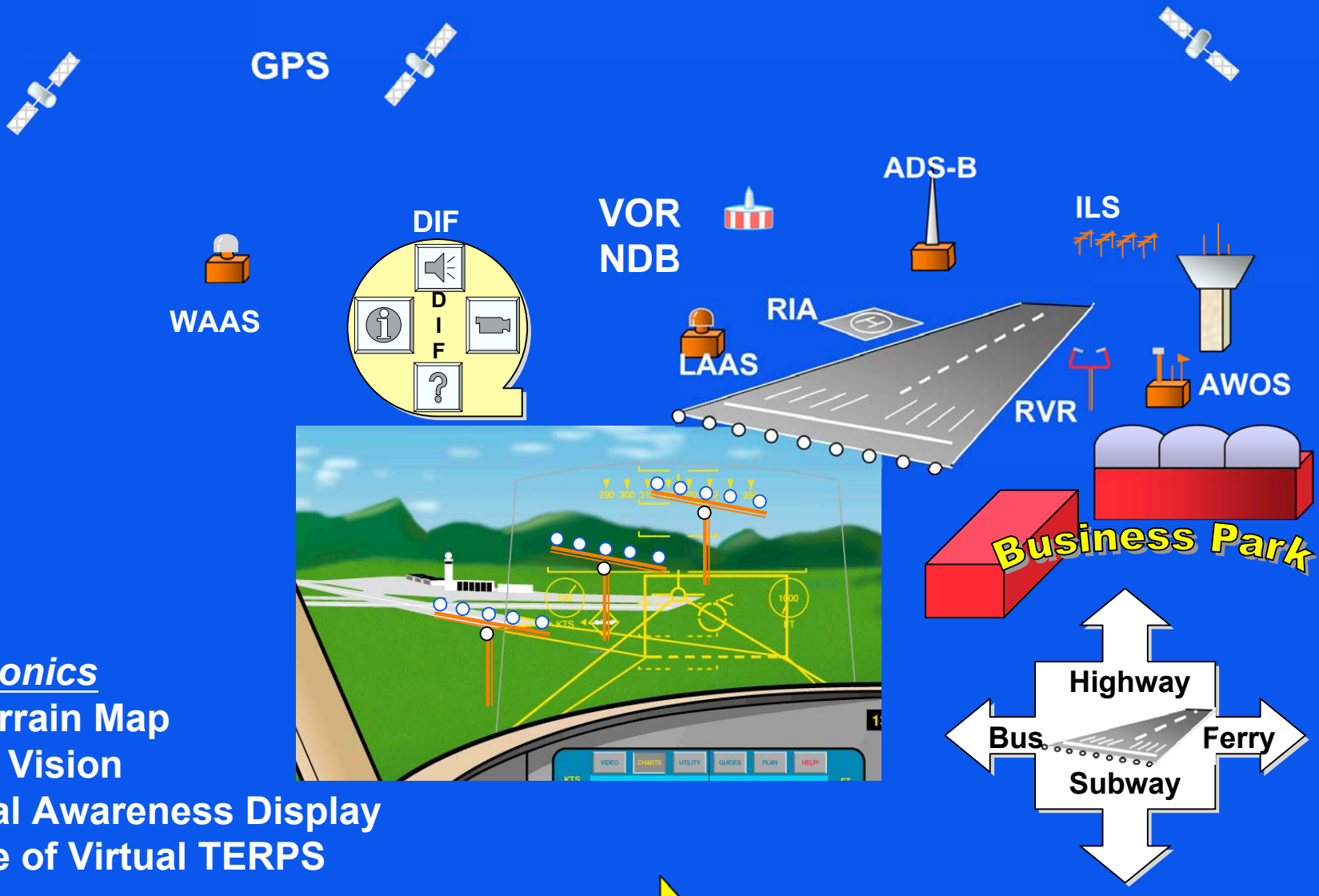


2000

18,000 Landing Facilities

5,400 Public Use

GA Landing Facilities: Past and Future



SATS Avionics

Digital Terrain Map
Synthetic Vision
Situational Awareness Display
Some **Use of Virtual TERPS**

2007

25% of Public Use Landing Facilities

Virginia SATSLab

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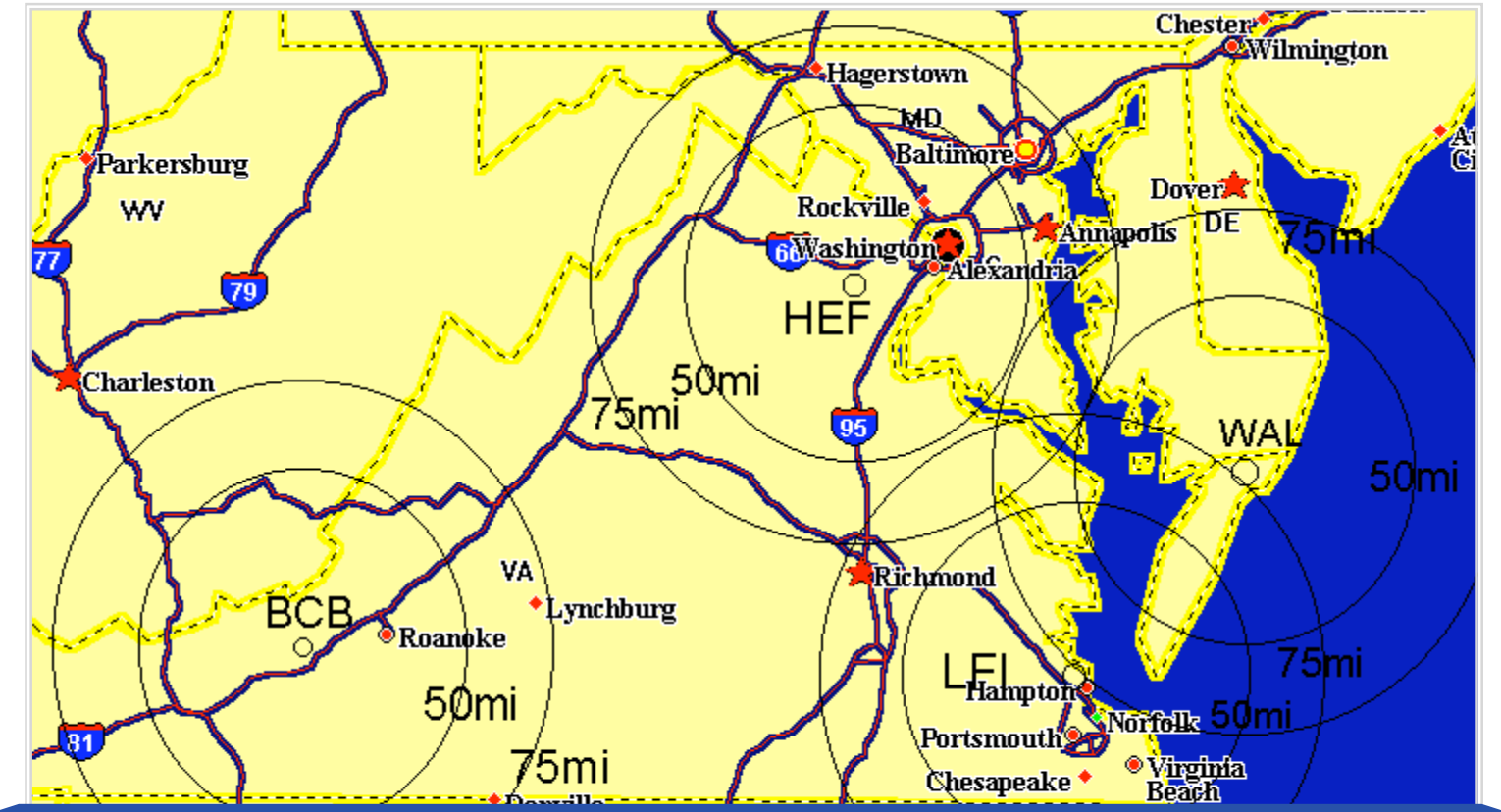
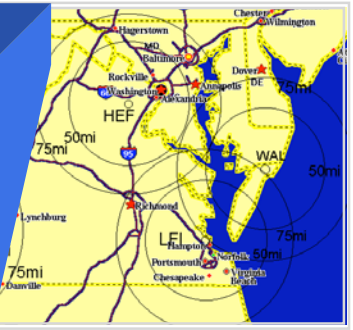


- Highway in the Sky (HITS) Precision Guidance to All Runway Ends
- Satellite-based Airborne Internet, Client-Server architecture
- VFR 20:1 Approach Zones in IMC using "Virtual" TerPs
- Towerless, Radarless Operations with self-sequencing & separation

SATSLab Demonstration
Scenario Designs

NASA Office of Aero-Space Technology



20:1 RPZ Approaches

- What approach and landing minima apply when using synthetic vision with Highway in the Sky operations?
- What lighting requirements apply when using synthetic vision with Highway in the Sky operations?
- How many aircraft can simultaneously operate in a non-towered, non-radar airspace?
- Under what conditions can Terminal Procedures (TerPs) be "virtual" (*I.e.,* computed on-board in real-time)?
- When should the Server *versus* the Client make separation & sequencing decisions?
- What are the impacts of emergencies on equipage and procedures?
- How can intersecting runways be used in "Virtual" VMC?
- How much of the visual segment of the approach can be presented in "virtual" computer graphics, *versus* actual out the window transition?

SATSLab Demonstration
Scenario Designs

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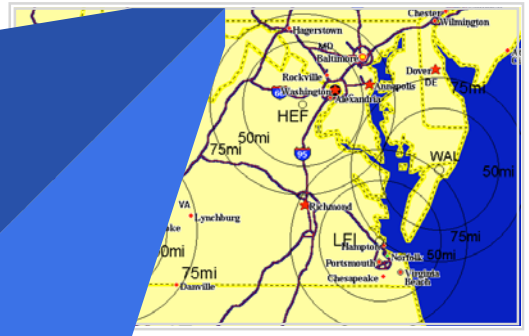

Simultaneous Non-Interfering Approaches

- What mix of procedures and equipage will allow for SNI?
- Under what conditions will SNI work with Land and Hold Short operations?
- What are the impacts of emergencies on equipage and procedures?
- What approach and landing minima apply when using synthetic vision with Highway in the Sky for SNI operations?
- What procedures and equipage will allow for transient corridors in Class B airspace for SNI?

SATSLab Demonstration
Scenario Designs

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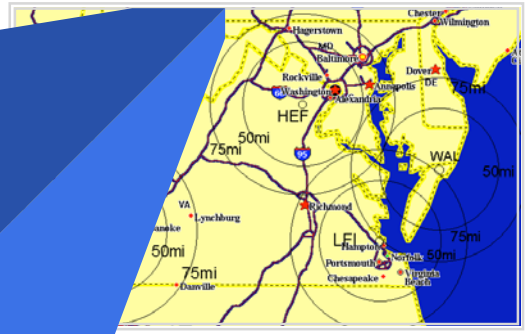

SATS EnRoute

- What procedures and equipage will permit dynamic access through Special Use Airspace without voice communication?
- What limits in routing and altitude segments can be pilot-controlled?
- What are the impacts of emergencies on equipage and procedures?
- When should the Server *versus* the Client make separation & sequencing decisions?


The Small Aircraft Transportation System is a safe travel alternative
freeing people and products from transportation delays,
by creating access to more communities in less time.
"Reduce public travel times by half in 10 years and two-thirds in 25 years"
http://sats.nasa.gov